

Kentucky Geological Survey

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Our mission is to
increase knowledge and
understanding of the
mineral, energy, and
water resources,
geologic hazards, and
geology of Kentucky for
the benefit of the
Commonwealth and
Nation.

In this issue

Developing coalbed methane	1
Helping communities find water supplies	1
Director's desk	2
Geology and planning in Kentucky	2
Earth Science Week 2003	2
In focus: Digital geologic mapping for the Commonwealth	Insert
Technology transfer	3
Spotlight on new publication	3
Calendar of events	4
Awards	4

Geologic feasibility

Developing coalbed methane

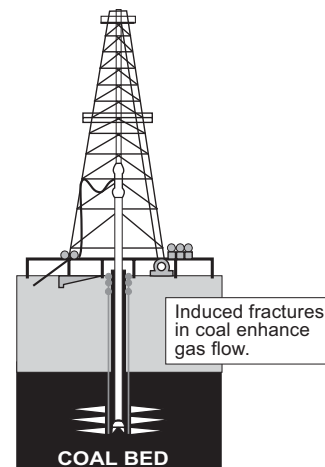
Cortland Eble, a coal geologist at the Kentucky Geological Survey, received a grant of \$1.5 million from the U.S. Department of Energy to assess coalbed methane resources and test production in the Illinois Basin. KGS will collaborate with the geological surveys of Illinois and Indiana in this 3-year project.

The Illinois Basin has more than 325 billion tons of remaining coal resources that is estimated to contain 11 trillion cubic feet or more of coalbed methane, a gas that occurs in association with coal. When coal is formed, large amounts of gas (mainly methane) are produced—more gas than the coal can hold. Some of this gas escapes into other rocks or into the atmosphere, but some remains in the coal. More information is found in a fact sheet at www.uky.edu/KGS/education/education.html.

To date, very limited amounts of the coalbed

methane in the Illinois Basin have been produced, mainly because historical data have indicated low, uneconomic gas contents. More recently acquired data suggest, however, that gas contents in certain areas of the basin may be much higher than previously thought. As coal production in the basin continues to decline, mainly because of the high sulfur contents of most of the coals, production of coalbed methane may be an effective way to use this vast energy resource to serve markets in Illinois and Indiana. Development of this resource would also contribute to the energy security of the nation as a whole.

The goal of the project is to obtain fundamental methane-content, permeability, and well-completion data for Illinois Basin coals from a selected set of core holes. Detailed geologic analysis will be done to determine the selection of well sites that provide possible areas of economic development of



Drilling for coalbed methane: a conventional well like those used for natural gas is drilled, then fluid is forced down the well to fracture the coal, which releases methane gas.

coalbed methane. The results of the exploration program will be used to identify one area that will undergo additional closely spaced drilling and serve as a well-completion site. Various fracturing methods, designed to enhance the flow of gas out of the coal, will be tested to determine the best method for maximizing production. An advanced drilling program, the first of its kind for coalbed methane exploration in the Illinois Basin, will also be used. The analyzed data and results will be made available to the public in publications, on a Web site, and at regional workshops. The project results should encourage private industry to explore and develop this important energy resource.

For more information, contact Eble at 859.257.5500 ext. 149 or by e-mail at eble@kgs.mm.uky.edu. ❖

Abandoned coal mines

Helping communities find water supplies

The Kentucky Geological Survey received a grant for \$50,000 for fiscal year 2003–04 from the Kentucky Infrastructure Authority in the Governor's Office to help communities across the Commonwealth develop groundwater supplies for drinking water. Hydrologists at KGS will examine abandoned underground coal mines and delineate fracture zones in rock that will produce large supplies of groundwater. In this joint

effort by the KIA, KGS, and local governments, groundwater quality and quantity will be assessed by drilling water wells and sampling water in coal mines so that local government officials can plan for future water-supply needs.

Jim Dinger, head of the Water Resources Section at KGS, is directing the program. For more information, contact Dinger at 859.257.5500. ext. 163 or by e-mail at dinger@kgs.mm.uky.edu. ❖

Director's Desk



Last summer we held a press conference in Lexington to announce the launching of our online system of oil and gas well records. As we anticipated, the response from the oil and gas industry and State government officials was extremely positive.

Shortly after the system was launched, an oil and gas producer in Texas called. He wanted information about Kentucky oil and gas wells. One of our geologists was able to guide him through our online system, and he had the information he needed within minutes of calling. This client exclaimed that he did not know of any comparable online system. Last month, in our Public Information Center, I met an investor from Europe who was accompanied by a Kentucky oil producer. The investor told me how pleased he was to be able to access the oil and gas well records he needed in Kentucky from the convenience of his office in Europe. He described the KGS online system of oil and gas well records as "the best in the world." This feedback confirms the

quality of public service we are providing.

When we established our online system, we created a single portal where users could access information and data from all our databases (www.uky.edu/KGS/pubs/lop.htm). In effect, we wanted to create "one-stop shopping." Having highly publicized our oil and gas well records, we were curious to see if there would also be increases in access to the other KGS databases available on the Web.

We recently examined some statistics that represent the number of database searches on our Web site by users on a daily basis. The results were quite remarkable. On a daily basis, the number of searches were:

- ◆ 150 to 200 for all KGS databases
- ◆ 100 for oil and gas well records
- ◆ 30 to 40 for publications
- ◆ 15 to 20 for water well and spring data
- ◆ 5 to 10 for coal borehole and thickness records



If we use the conservative number of 150 searches a day, 5 days a week for a normal workweek, for 52 weeks, the annual total is 39,000 searches. This is approximately four times more than the number of traditional inquiries (telephone, fax, e-mail, drop-in customers) that we respond to annually. This is just the beginning! Watch for new developments as we continue to enhance this vital public service.❖

James C. Cobb

Digital geologic maps and data — Geology and planning in Kentucky

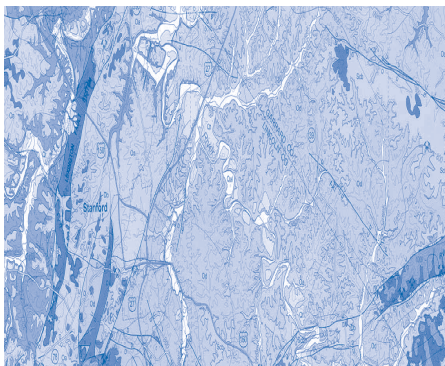
In the spring of 2003, a new initiative was launched to explain how digital geologic maps and data are essential for planning decisions about land use, environmental protection, and mitigation of natural hazards in urban and rural areas. This initiative was undertaken in cooperation with the Kentucky League of Cities' NewCities Foundation Leadership Center Program (www.newcities.org) and the Kentucky Association of Counties

(www.kaco.org). **Drew Andrews, Carol Ruthven, Dave Williams, Dan Carey, and Jim Cobb** have given presentations on geology and planning at seminars in Berea, Elkton, LaGrange, Mount Sterling, Lexington, Kentucky Dam Village State Resort Park, London, Fort Mitchell, and Bowling Green. The seminars will be offered in other communities in the future.

A workshop demonstrating the use of digital geologic data in land-use

planning and GIS applications was presented by Cobb and Ruthven at the spring conference of the Kentucky Chapter of the American Planners Association in Rough River Dam State Resort Park in western Kentucky on May 23.

For more information about the geology and planning presentations, contact Ruthven at 859.257.5500 ext. 128 or by e-mail at cruthven@kgs.mm.uky.edu.❖



Earth Science Week 2003

Mark your calendar for October 12–18: Earth Science Week 2003 (www.earthsciweek.org). This year's theme is "Eyes on Planet Earth: Monitoring Our Changing World." Join us for an open house on Wednesday, October 15, co-sponsored by KGS, the UK Department of Geological Sciences, the Kentucky Water Resources Research Institute, and the Tracy Farmer Center for the Environment. For more information, contact Carol Ruthven at 859.257.5500 ext. 128 or by e-mail at cruthven@kgs.mm.uky.edu.❖

Digital Geologic Mapping for the Commonwealth

Warren H. Anderson and Gerald A. Weisenfluh

August 2003

The Digital Geologic Mapping Program

The Digital Geologic Mapping program (www.uky.edu/KGS/mapping/mapping.html) has been one of the largest and most successful programs of the Kentucky Geological Survey during the past 7 years. It is providing the foundation of digital mapping and the database structure for future digital and Web-based products and services. It is a cooperative effort between KGS and the U.S. Geological Survey, as part of the National Cooperative Geologic Mapping Program (ncgmp.usgs.gov).

The program began in the early 1990's when Donald Haney, the eleventh director of KGS, was instrumental in securing national legislation that would allow the United States to be mapped geologically. Of specific interest was a provision that allowed states such as Kentucky, who were already mapped, to convert existing maps into digital products.

Public Law 102-285, the "National Geologic Mapping Act," was signed into law by President Bush in May 1992. It

mandated that the entire United States be mapped geologically. The legislation was reauthorized in 1998.

The Kentucky Geological Survey has used funding from this program to produce 7.5-minute digital geologic quadrangle maps at a scale of 1:24,000 (1 inch=2,000 feet).

Program achievements

The initial goal was to have complete digital coverage for the entire state by the year 2007. Currently, the program staff are ahead of schedule, and complete digital coverage is expected by the end of 2004.

When the digital coverage for the entire state is completed, Kentucky will become the first state in the nation to achieve this milestone. By the summer of 2003, more than 650 of the 707 quadrangles (7.5-minute, 1:24,000 scale) had been digitized.

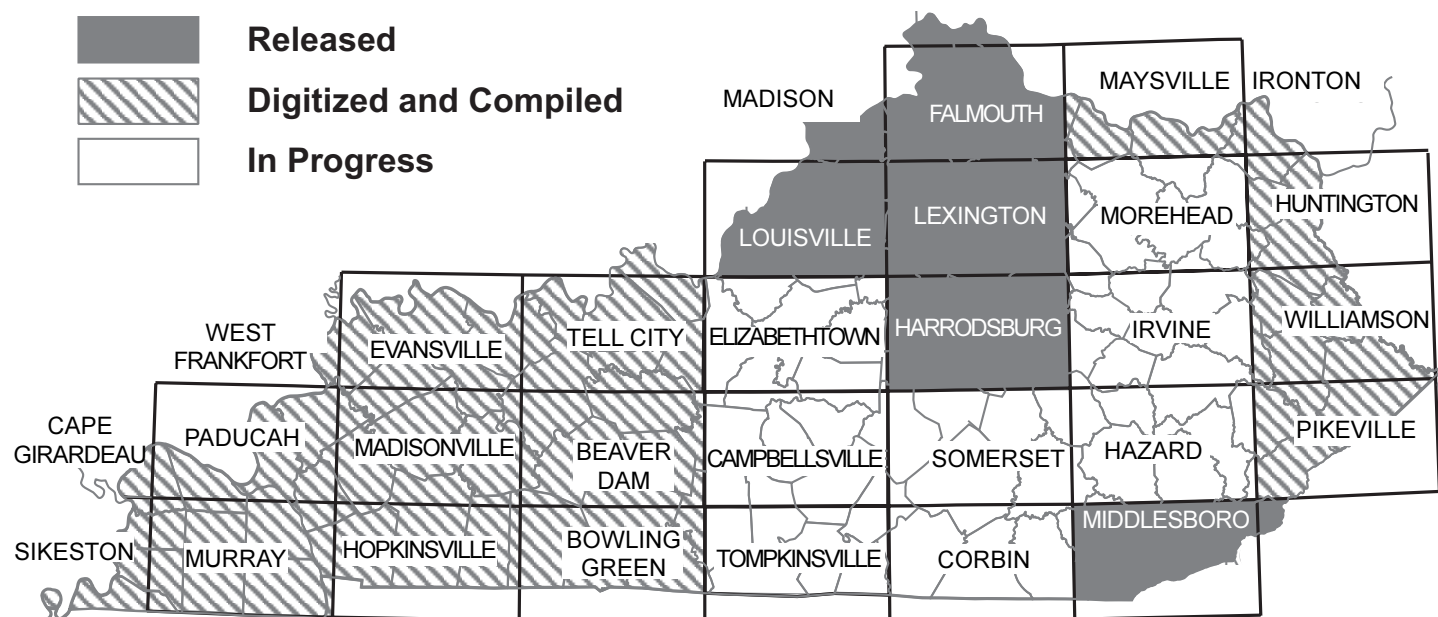
The versatility and power of digital data: DVGQ's

Geologic maps are complex; they contain various kinds of informa-

tion that relate to the age, composition, and structure of mineral features. Because of this complexity, the information cannot be stored in a single data structure. Individual themes must be created to represent different kinds of geologic features in a digital format. Geologic features are rendered in vector format to permit variation in scale without degrading quality. The geologic map data are supplied in ESRI shapefile format for use in geographic information systems. Commercially and publicly available software can be used to view or analyze the shapefiles on a personal computer.

The availability of the data in GIS format allows the data to be manipulated and separated into their component parts. This is achieved by creating a database of information that is attached to the digital files. The databases of geologic information are referred to as "digitally vectorized geologic quadrangles." The DVGQ's are not a facsimile of the original published paper map.

In the DVGQ's, which are released on CD-ROM, geologic features are



Areas for which DVGQ's have been released. This map shows 30 x 60 minute quadrangles. Each 30 x 60 minute quadrangle is compiled from multiple 7.5-minute quadrangles.

represented as vector points, lines, or areas. Characteristics and descriptions of the features are also provided.

Geologic features stored in a DVGQ database can include:

- ◆ formation area: the surficial areas of rock units that compose a geologic map
- ◆ formation contacts: the upper and lower surface boundary of each rock unit
- ◆ structural features: structure contours, erosional surface contours, and anticlinal and synclinal axes
- ◆ structural measurements: strike and dip measurements for bedding and joint surfaces
- ◆ faults: faults, fractures, and fault scarps
- ◆ thin beds: rocks units that were too thin to digitize as polygons
- ◆ coal locations: coal outcrop locations
- ◆ economic features: arcs of mineral veins and mine outlines
- ◆ economic locations: noncoal and economically significant mineral outcrops and prospects, mines, quarries, pits, shafts, etc.
- ◆ drillhole locations: locations of geologically significant drillholes
- ◆ intrusive features: dikes and sills
- ◆ intrusive locations: points of dikes and sills
- ◆ fossil locations: fossil locations and sample sites
- ◆ fossil horizons: fossil layers and sample transects.

As many as 14 different themes that relate to geologic features on the original geologic quadrangle map make up the database, but not all are present for every DVGQ. Of the more than 650 digitized geologic quadrangle maps, 150 have been released on CD-ROM as DVGQ's.

Information from other digital products, such as digital ortho-quarter quadrangles, digital elevation models,

digital raster graphic images, and satellite imagery, can also be used as a base for the DVGQ data. The digital geologic data, when combined with other spatially referenced data, can create a powerful geologic information management system.

Information about the DVGQ data sets and a sample data set are available at www.uky.edu/KGS/gis/DVGQ/homepage.htm. Information on the digital geologic maps and other GIS products are available at www.uky.edu/KGS/gis/intro.html and www.uky.edu/KGS/mapping/mapping.html.

The value of digital geologic maps

Digital geologic information can be used for land-use planning, environmental protection, hazards mitigation, and mining activities. Digital map data are also valuable for assessment of coal, mineral, and petroleum resources; construction and urban development; engineering, planning, and reclamation; and water-supply and waste-disposal studies.

Geologists at KGS have cooperated with the Kentucky Transportation Center at the University of Kentucky and the Kentucky Transportation Cabinet to provide digital geologic maps for the proposed I-66 highway corridor between Somerset and London, as well as the Glasgow to Bowling Green segment. In 2000 KGS staff used digital geologic data to assess the remaining near-surface coal resources in eastern Kentucky for the U.S. Office of Surface Mining. These cooperatively funded projects demonstrate the multidisciplinary value of geologic maps.

New geologic maps and derivative map products

The digital geologic data have been used to create several new geologic map series. The first is a 1:100,000-

scale compilation of the 7.5-minute data. These paper maps provide a regional perspective of geology with the fidelity of detail of the original 1:24,000-scale geologic quadrangle maps. A county geologic map series is planned as well; the first maps are being published on a print-on-demand basis for the central Kentucky area.

The digital data are being used to make maps for county land-use planning. Each map provides a simplified geologic map of the county and an interpretation of the local geology in nontechnical language. The maps include information on how the underlying rock in an area affects land use (for example, excavation and foundations, on-site wastewater treatment systems, residential and industrial developments, highway and street development, pond and reservoir construction, etc.). Photographs of sites in the area are used to illustrate the geologic discussion. This derivative map product can be used by homeowners, developers, and planners.

Future directions

The newly created digital map data are being incorporated into a database of spatial information that will be accessible through the Web. An Internet map server is being used in conjunction with the database to provide easy access to the land-use planning maps.

The new maps and derivative map products can be viewed using the Internet map services at kgsweb.uky.edu/arcimsSearch.asp. A tutorial for their use is provided.

For information about the Digital Geologic Mapping program, contact Warren Anderson at 859.257.5500 ext. 151 or send an e-mail to wanderson@uky.edu. For information about the DVGQ's, contact Jerry Weisenfluh at 859.257.5500 ext. 114 or send an e-mail to jerryw@uky.edu. ❖



Oil and gas well records

Since June 1, 2003, the KGS **Oil and Gas Well Record Room** at the Lexington Office has been open by appointment only. The public can now access oil and gas well records on the KGS Web site at www.uky.edu/KGS/pubs/lop.htm without having to travel to the KGS offices in Lexington or Henderson. The online records may also be accessed using computers in the **Public Information Center**, located in room 104 of the Mining and Mineral Resources Building on Rose Street in Lexington. KGS staff can offer assistance in locating data, and there are facilities for obtaining copies of the records and other software.

If you still wish to examine the paper records, please make an appointment by calling 857.257.5500 ext. 120. Although 24-hour notice is appreciated, KGS staff will always try to accommodate your needs. ♦

Stream data online

Do you need stream data? KGS can help. Did you know that almost 90 percent of Kentuckians are served by public water systems? Kentucky has more than 89,400 miles of rivers and streams and 637,000 acres of wetlands. Concerns about Kentucky's water quality and supply are of interest to all its citizens.

Kentucky and Hawaii are the only states to have complete hydrographic map coverage. High-resolution national hydrography data sets for Kentucky are available at www.uky.edu/KGS/gis/hydro.html. The data set, completed in March, provides mapping, flow descriptions, and other features of surface water in Kentucky on a 1:24,000 scale (1 inch= 2,000 feet).

Jim Currens compiled data from regional karst dye-trace experiments in Kentucky. **Dan Carey** compiled data analyzing water wells in Kentucky. This online information will make it possible to analyze water chemistry, flow rates, and fish habitats. This hydrographic data set can also be used to determine underground water flow, which is valuable information for builders. For more information, contact Dan Carey at 859.257.5500 ext. 157 or by e-mail at carey@kgs.mm.uky.edu. ♦

— Jill Bramwell

New location for Henderson field office

The KGS field office in **Henderson** has moved. The new address is 1401 Corporate Court, Henderson, KY, 42420 (telephone: 270.827.3414; fax: 270.827.1117). ♦

Governor's Geographic Information Advisory Council

In January, **Jerry Weisenfluh** was reappointed to the Governor's Geographic Information Advisory Council for a 3-year term. He represents the Kentucky Society of Professional Geologists. ♦

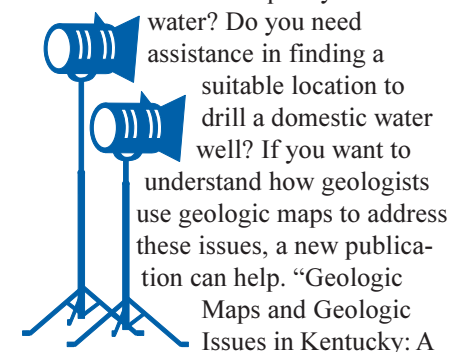
KGS featured on ESRI Web site

An image of one of the KGS Groundwater basin maps is featured on the ESRI (Environmental Systems Research Institute) Web site as an example of the application of ESRI's ArcView software (www.esri.com/industries/cavekarst/examples3.html). This will provide considerable publicity for the KGS groundwater basin maps, because ESRI has 11 regional offices in the United States, more than 75 international distributors, and users in more than 220 countries. ♦

Spotlight on new publication

Citizen's guide to geologic maps

Have you had problems with flooding or cracked foundations? Have you wondered why the world-renowned thoroughbred horse farms are located in central Kentucky? Have you seen houses, buildings, and cars buried in rubble from landslides and wondered why the landslides occurred? Would you like to know about the quality of well



water? Do you need assistance in finding a suitable location to drill a domestic water well? If you want to understand how geologists use geologic maps to address these issues, a new publication can help. "Geologic Maps and Geologic Issues in Kentucky: A Citizen's Guide," by **Carol Ruthven, John Kiefer, Steve Greb, and Drew Andrews**, has colorful illustrations and photos that complement a simple, easy-to-understand explanation of the uses of geologic map information.

The publication, which includes a free geologic map, may be ordered by calling 859.257.3896 or 1.877.778.7827 (toll free). The publication is also available as a PDF file (www.uky.edu/KGS/pubs/lop.htm). ♦

AAPG National Core and Sample Preservation Committee

In May, **Patrick Gooding** was appointed by the Kentucky Society of Professional Geologists to serve as a delegate to the American Association of Petroleum Geologists for a 3-year term. The AAPG House of Delegates is composed of delegates from affiliated professional societies and regional representatives from around the world. Gooding was appointed by AAPG to serve on the AAPG National Core and Sample Preservation Committee. The mission of the committee is to promote collection, preservation, and use of samples and cores, as well as those data directly attributable to this rock material. The Survey has the fifth largest core and sample library in the country. ♦

KGS mailing list

Would you like to receive the KGS newsletter and announcements of meetings and new publications? Please call us at 859.257.5500 ext. 128 or send an e-mail message to **Carol Ruthven** at cruthven@kgs.mm.uky.edu—simply type

“Electronic-Mailing List Addition” in the subject line of your message, type your mailing address and phone and fax number in the message—and we will include your name and address in our mailing list. ❖

Calendar of events

- ♦ **September 18–20:** KSPG fall field trip to the Middlesboro–Cumberland Gap vicinity, commemorating the designation of the area as Distinguished Geologic Site 3, www.kspg.org
- ♦ **October 12–18:** Earth Science Week 2003 (www.earthsciweek.org), KGS Open House on October 15, contact Carol Ruthven at 859.257.5500 ext. 128 or by e-mail at cruthven@kgs.mm.uky.edu
- ♦ **November 2–5:** Geological Society of America national meeting, Seattle, Wash., www.geosociety.org/meetings/2003
- ♦ **November 19:** Geology, GIS, and Planning workshop, Lexington, contact Carol Ruthven at 859.257.5500 ext. 128 or by e-mail at cruthven@kgs.mm.uky.edu ❖

Awards

Chad Willis, an agricultural producer who lives in Newbern, Tenn., received an award for outstanding contributions to the University of Kentucky and KGS. The award was presented by Assistant State Geologist **John Kiefer** at the 43rd annual meeting of the Survey in Lexington on May 16. In the past 10 years, Mr. Willis has cooperated with UK and KGS seismologists who set up a seismic station on his property in **Fulton County**. His cooperation and assistance has facilitated research on seismic activity in the New Madrid Seismic Zone.

Brandon Nuttall and **Steve Cordiviola** were honored on May 10 by the American Institute of Professional Geologists–Kentucky Section. They were joint recipients of the **Kentucky Geologist of the Year** award, in recognition of their outstanding contributions to the Commonwealth of Kentucky. They have been instrumental in developing a Web-accessible database for the vast collection of oil and gas well records and geophysical logs archived by the Kentucky Geological Survey. ❖

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